

Design and Development of Device to measure Body Fat using Multi-frequency Bio-impedance Method

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Abstract. Obesity is the beginning of the emergence of various chronic diseases such as stroke, heart failure, diabetes, and so on. Therefore, obesity becomes one of the indicators to know the health condition. Obesity can be known from Body Mass Index (BMI). BMI only considers weight and height, while obesity is related to fat composition, so this information is less valid. One method that can calculate body fat composition is Bioelectrical Impedance Analysis (BIA). BIA works by injecting a constant current into the body and measuring its voltage. This research designs and develops device to measure the body fat content with multi-frequency bio-impedance method. The study was conducted by generating a multi-frequency sine wave from AD9850 accompanied by a DC block so that an AC sine wave was generated. It would be converted into a constant current on VCCS. The electric current is injected into the body through two electrodes and the voltage was tapped by two another electrodes. The voltage are processed by instrument amplifier (AD620). AC signal from AD620 is converted to DC signal by AD536. Analog data is processed by ADC in the microcontroller so that the body impedance is obtained. The device was tested on 7 volunteers. The calculation of body fat was compared with standard OMRON HBF 214 device. In this research we got the linearity equation $y = 0.999x + 0.161$ with $R^2 = 0.997$ as the result of correlation between the body fat from reference (x) and the measurement of body fat from the device was developed (y).

Keywords : body fat, multi frequency, bio-impedance.

1. Introduction

Data from the Indonesian Health ministry [1] shows that Indonesia is one of the countries that has complex nutritional problems due to cases of obesity. The National Health Research Data in 2016 [1] showed that people aged over 18 years who obese were 20.7%. This shows a significant increase from 2013 which was only 15.4%. This condition is categorized as alert which needs serious attention.

Obesity is a disease where extra calories are stored in the body in the form of excessive fat. Obesity is the beginning of the emergence of various chronic diseases such as stroke, heart failure, rupture of blood vessels, diabetes, and so on. These chronic diseases have a risk of disability, impaired body function, and death. According to WHO, obesity is ranked fifth cause of death.

Obesity is caused by unhealthy lifestyles, such as physical inactivity, body metabolism, genetic factors, and unhealthy food so that the distribution of body fat is uneven and accumulates. The solution is to return to a healthy lifestyle, sport, maintain nutritious food and monitor body weight.

